population was 5.1, which represents an increase of 0.2 over that of the previous year. In the same year out of a total of 9.22 million pupils undergoing instruction in the primary schools, only 1.32 millions went to the middle schools and 9.22 lakhs were found in the high schools and 9 02 thousand entered the university. These figures give an impressive idea of the wastage of pupils in every grade of education and the appalling waste of public funds on the so-called education of 8 millions of pupils who simply lapse into illiteracy again. Looking at the spread of education among the different communities, we discover that the percentage of pupils to the total of the Hindu community is 4.8, which is 0 6 per cent less than the Muslims and 17.4 per cent less than the Parsis and yet the Hindus form the major community of the total population. The average annual cost of educating a pupil is about Rs. 23–0–10 and of this amount nearly Rs. 20 brings little or no return to the expending authorities, on account of the wastage of pupils in the successive stages of their educational career. Without entering into the subject of industrial and technical schools, we have stated the problems arising from a perusal of the official documents relating to general education and we are struck by their formidable nature as soon as we try to find anything approaching a satisfactory solution under a ten-year plan. If we can devise means for preventing or minimising the volume of lapses into illiteracy, we shall consider ourselves as having offered a helpful suggestion to the promotion of education among the people of India. These problems and others directly or indirectly related to education, such as those pertaining to the industrial, economic, social and political life of the country, will be dealt with in our columns as time and space permit.

The cardinal point of our contention is that progress in any department of public activity should not be the outcome of mere accident or haphazard policy, but should be the result of pursuing a specific and carefully worked-out plan spread over a definite period of time. To ensure the success of such plans, the movements must spring from the heart of the people and must not be imposed on an unwilling and untrained populace. On the other hand, the authorities and well-to-do classes will have to realize sooner or later,—the sooner the better,—that they will be able to maintain for themselves the means of living in comparative opulence, leisure and comfort, only if the masses also are placed in a position to enjoy such a life at least in a small measure. The Earl of Oxford once declared of England that, "The course of our constitutional progress has been in the main not an alternation of revolution and reaction, but a course of more or less even development." We are of opinion that the progress in the spheres of human activity with which we propose to deal, should proceed uniformly and rapidly along the lines of equally "even development" and we propose to base our suggestions for a ten-year plan on this most acceptable and wise doctrine.

The Indian Institute of Science, Bangalore.

IT will have been a cause for general satisfaction among the Indian community of science to learn that Sir C. V. Raman has been appointed to the Directorship of the Indian Institute of Science, Bangalore, which becomes vacant early next year by the retirement of Dr. M. O. Forster. The occasion is a suitable one for reviewing some historical aspects of the Institute and forecasting a few developments which may be anticipated.

Since the opening of the laboratories in 1911, the Institute has always been a subject of considerable interest to the general public, which from time to time has offered advice directed towards improvement of its service to India. Such advice has not invariably taken the form of constructive criticism, because its authors have not sufficiently realized that a new institution, entirely novel to the country and therefore without a fund of experience on which to draw, must pass through an exploratory period of development before a recognizable tradition emerges. That stage having now been reached, however, the following observations may perhaps be regarded as timely.

Early expectations of revolutionary improvement in scientific industry and spectacular development of new industries, having been based on imperfect appreciation of the factors involved, were not fulfilled. Twenty years ago it was not generally realized that although laboratories for training students

in the scientific principles underlying industrial processes and in the methods of scientific research may be the cradle of a new industry, they cannot carry the infant enterprise beyond a very elementary stage. Higher authorities concerned in establishing the Institute were very definite on this point, however, as appears from a resolution by the Government of India in this matter, dated 27th May, 1909. During the discussion then prevailing, Government "were of opinion that the idea of combining in one institution, and entrusting to a single staff of professors, both the teaching of science and the experimental development of new industries, was open to the obvious criticism that these two objects were in no way connected with one another." Moreover, the two educational experts finally deputed to frame a scheme recommended "that the Institute should be devoted to experimental science, and should aim at training students in experimental methods, carrying on original research, and discharging the functions of an accepted authority and referee on all scientific problems within its own domain."

Furthermore, it is evident that these higher authorities appreciated the tentative aspect of the plan then to be launched, because in the concluding passages of the Resolution above quoted, the Governor-General in Council realized, "that the results of the experiment that is now about to be tried will depend less upon the conditions of the project itself than upon the character and energy of those who may come forward to take advantage of the facilities for advanced studies which it will offer." Finally, the Vesting Order founds "an Institute of Research in India" and the attached scheme of administration inculcates "the promotion of original investigation in all branches of knowledge and their utilization for the benefit of India," without specific mention of industrial activities.

Reflection on the cultural principles involved will tend to confirm the opinion of these authorities. If the training of students in methods of inquiry is to be the primary object of an institution—and the above quotations clearly establish that intention for the Institute—it is necessary that the subjects selected should have instructional value, and outside the factory itself such subjects are less commonly found among the class of problems arising from industrial processes than in the academic field. For example, a student might easily spend two years in trying (successfully or unsuccessfully) to raise by 5 per cent. the yield of a chemical product, without gaining much insight into the technique of chemical research: whereas, on the other hand, a well-chosen academic exercise may in the same period equip him with the mental machinery for solving many problems quite alien to the one he did solve. Moreover, modern industrial research has long passed beyond the stage when a lad of eighteen, trying to synthesise quinine, can stumble on mauve and then, by an amazing exertion of skilful diligence and the loyal support of his relatives, proceed to found a colossal new industry. The successful application of science to manufacture nowadays depends principally on team work by highly trained men, temporarily freed from the necessity of equipping themselves with further technical qualifications and then seeking employment. Those who think otherwise may profitably study *Searching into the Unknown*, by the General Electric Company, Schenectady, N.Y.

Nevertheless it is apparent that those responsible for developing the resources of the Institute, while placing in the foreground the requirement to impart advanced knowledge, and instruct in the methods of research, have consistently kept in mind any possible bearing which the results may have on the inception of new industries and the improvement of existing ones. Ample evidence of this recurs each year in the appendix to the Council's report, showing in abridged form the current subjects of investigation; but although the technological application of the work at the Institute has been wide, and in several cases valuable, there is doubtless room for expansion in this field. As pointed out by the Quinquennial Reviewing Committee, there should be close collaboration between the Institute and the Scientific Surveys, the Telegraphs Department, the Meteorological Department, the Railway Board, Chambers of Commerce and the Directors of Industry throughout India. Association with these entities does occur, but it has not resulted in many problems being referred to the Institute.

Most of the subjects with an economic application latterly engaging the attention of the Institute have in fact been initiated therein, as instanced by the systematic inquiry into the cause of spike-disease in sandal. This has now continued during the past five years in co-operation with the

Government of Madras and the Coorg Commission, the results being summarized in periodical reports published separately from the Journal of the Institute. The latter publication contains a description of the various inquiries, academic and economic, which have been pursued in the laboratories and in the past fifteen years has comprised about 200 issues. The range of subjects is wide, and includes many that might be turned to an industrial utilization of principles or materials. This aspect of the work is reflected in the fact that the major proportion of the Institute's former students have been absorbed into non-academic occupations, particularly in the field of electrical technology. The development of this department has been very notable, both in heavy electrical engineering and in the section of electrical communication; and in this connection it may be explained that the primary object of the department has been to provide advanced courses of instruction supplementary to those obtainable in the universities and engineering colleges. Hitherto, the facility with which students trained at the Institute have gained employment in the rapidly growing electrical industries has disinclined all but a small proportion to prolong their sojourn at the Institute for the purpose of research.

The main object for which the Institute was founded, as defined above, is being steadily enlarged. Fifteen years ago the number of workers in the various departments was 41; during the year lately closed the corresponding total was 142. In the same period the strength of the staff has grown from 9 to 26, and it is noteworthy that of this number 19 are former students of the Institute, thus fulfilling one of the most earnestly cherished wishes of the late Founder, Sir Dorabji Tata. Out of all proportion to the growth in the number of students has been the increased aid rendered annually in the form of scholarships, etc., which has expanded from Rs. 4,700 to Rs. 53,800, while expenditure on working and equipping the laboratories has trebled, being Rs. 65,100 against Rs. 22,600. Fifteen years ago the outlay on periodicals and new books was Rs. 2,100, while to-day it is Rs. 16,000.

Although this chronicle of development suggests that the financial position of the Institute is reassuring, there are some features of instability to which attention should be drawn. Sir Dorabji Tata's hope, shared by all those who have the progress of the Institute at heart, was that it should become an all-India institution. In the sense that its students are drawn from almost every part of the sub-continent the hope has been realized with this reservation, that for geographical reasons a largely preponderating number is received from Mysore and Madras. It is regrettable, however, that this all-India feature is not reflected in the sources of revenue. Among these the return on the original endowment with interest on savings and the annual subvention by Government of India represent 88 per cent. of the total, and the major portion of the remainder is contributed by the Government of H. H. the Maharaja of Mysore, which has generously granted Rs. 50,000 per annum hitherto, in conformity with a promise made when Bangalore was finally selected for locating the Institute. From this it follows that, excepting Mysore and Hyderabad, which also has uniformly and generously supported the Institute, contributions from States and Provinces have been disproportionate to the benefits received by their students. For example, although during the past six years the numbers deriving from Mysore, Madras and Bombay have been approximately the same, with a distinctive advantage in favour of the two last named, the respective contributions have been Rs. 50,000, Rs. 5,000 and nil. This discrepancy calls for rectification, on grounds both moral and material. In the first place, absence of support from Bombay and Bengal may be used by other regions as an excuse for withholding assistance, or for reducing such aid as may be given already, and secondly, the revenue of the Institute has remained for some years stationary, and at the moment is declining.

Accordingly, it is necessary that wider resources become available, and without undue delay. With this provision the future, to which we now look for progress and expansion at least comparable with those of the last fifteen years, is full of hope. This is not the place in which to panegyrise the scientific achievements of Sir Venkata Raman. These have not remained in obscurity, and they give promise that the Institute, without in any way diminishing its interest in possible industrial applications of its work, will add to its academic resources a department of physics as a link between existing activities in physical chemistry and electrical technology.

ALCHYMIST.

Unemployment in India.

SIR M. VISVESVARAYA'S thoughtful address[1] before the University Union, Bangalore, has provoked a considerable amount of fresh interest in this "Master Problem" of the age and, as mentioned in our previous number,[2] we take this opportunity to discuss the subject, in greater detail, in the light of the valuable suggestions made by that veteran statesman.

A critical study of the various causes which led to the present situation would show that, although the world-wide economic distress is partly contributory to increasing unemployment, the main causes are deep-seated and inherent to the conditions prevalent in India. Among the latter may be mentioned, (*a*) the disproportionately rapid growth of population in comparison with the limited resources of the country, (*b*) unbalanced occupational structure arising from neglect of industries and overcrowding on land, (*c*) want of adequate efforts on the part of the Government to encourage industries and to explore new avenues for increasing employment, and (*d*) certain defects due to faulty traditions of the people and disabilities arising largely from the trade policy and other similar measures pursued, for a long time past, with regard to the country.

During the past few years, the trade returns of the country have diminished considerably while the population has greatly increased. The birth rates are now far higher and the average income considerably less than those of most European countries, so that the standard of living has gone down with increased poverty and misery all round. According to certain thinkers, restriction of population has now become a necessity and it is pointed out that birth-control measures so successfully practised in all civilized countries should be adopted more extensively than in the past.

This view may not be shared by a certain section of the public, but, considering the already under-nourished condition of majority of women and children and the fatal consequences of frequent motherhood, it must be admitted that some voluntary type of birth restriction is in the opinion of these advocates needed to improve the general condition of, at any rate, a great majority of the population.

As Sir Visvesvaraya pertinently points out, the pressure on land has lately increased considerably without any appreciable improvement in output; indeed, recent statistics show that the total area under cultivation has appreciably diminished during the past few years. The above are largely due to (*a*) the agricultural population having increased out of all proportion with their earning capacity and (*b*) decreased foreign demand for Indian agricultural produce. Many of the countries that were once buying from India are now either raising the required articles or their substitutes in their own countries or are buying them from cheaper rivals. Although our cost of production is lower than those of most other countries, we lack cheap transport facilities and requisite organization for collecting and disposing of produce so that we are unable to compete with our rivals and are thus steadily losing ground on foreign markets. The majority of the agriculturists themselves are not, however, aware of this situation and early steps should be taken to educate them to their position and to stimulate co-operative effort to reduce the cost of production, improve the yield, pool the produce and organize internal as well as external trade.

So far, the main occupation of the majority of the population consisted in the production of raw materials for food and clothing which were disposed of, as such, to the buyers in the country and abroad. Except in textiles very little effort has so far been made to convert the produce into more valuable finished articles. As mentioned in a previous number,[3] the majority of the articles that contribute to human comfort and well-being are derived from agricultural produce and well placed as we are with regard to cheap man-power, a considerable portion of our future efforts should be directed towards the promotion of industries relating to the utilization of agricultural produce. Such a policy which requires the active support of the Government would not only relieve congestion on land but also stimulate output from the soil.

Although agriculture is the basic industry of the human race, it is yet a precarious

[1] Now published as 'Unemployment in India: Its causes and Cure', Bangalore Press, Bangalore (1932).

[2] *Cur. Sci.*, **1**, 60 (1932).

[3] *Cur. Sci.*, **1**, 30 (1932).